

and calcium are effective in the treatment of allergies only when injected, as the gastric juices destroy their effectiveness when taken orally. Further progress was made when Western medicine took over ephedrine, the effective substance contained in the Chinese *ma huang* drug, some twenty years ago. This can be taken orally and thus makes the patient to a certain extent independent of the doctor.

The study of the allergy problem has finally also revealed the inner mechanism of this affliction. We know today that the harmful substances—mainly protein products—together with the antibodies of the organism form a new substance, histamine, which causes the symp-

toms. In a healthy body, the mucous membrane of the small intestine produces a ferment which destroys the histamine constantly being formed in the body. In the case of functional disturbances in the small intestine, however, or when there is an unusually large supply of histamine, the body reacts to the histamine in the form of allergies. Meanwhile new medications have appeared on the market which destroy histamine and are manufactured, for example, from the mucous membrane of the small intestine. That means that now, in addition to desensitizing treatments, medical science has at its command means of attacking the very root of the allergic diseases.

THREE-DIMENSIONAL WEAPON

By HELMUTH KÖHRER

The warfare in the skies over East Asia has stimulated interest in the functioning of antiaircraft artillery. The following article comes from Germany, a country with great experience in the defense against hostile bombers.

"IN 1914 we were stationed with our antiballoon cannon near Baden-Baden, where we were entrusted with the defense of an airship hangar against enemy air attacks. Whenever the approach of enemy planes was reported, we ran from our quarters to the village fire station, which housed our cannon. One of us fetched the horses, which were hurriedly harnessed and mounted, and then we rushed off at a thundering gallop with our iron-rimmed wheels through the village street to meet the enemy. . . ."

So runs the story of a German antiaircraft artillerist in the Great War. From the horse-drawn antiballoon cannon to the modern antiaircraft batteries mounted on special railroad trucks it is a far cry.

The earliest beginnings of the antiaircraft cannon go back to the Franco-Prussian War of 1870/71. To the besiegers of Paris, the balloons by means of which the French maintained communications with the outer world were a source of annoyance. For the purpose of combating them, the Krupp works constructed an antiballoon cannon with a caliber of 3.7 centimeters, mounted on a four-wheeled cart. But the five cannons of the model were unable to inflict any damage on the balloons, which flew at an altitude of more than 1,000 meters. All the greater was the moral effect when the Germans succeeded on November 12, 1870, in shooting down a balloon flying exceptionally low. From that day on, no more balloons were sent up.

During the next 35 years no more interest was shown in this new weapon. But by 1906

airships had become improved to such an extent—mainly through Count Zeppelin's flights—that the War Ministry in Berlin developed an interest in the question of combating air targets. After experiments made with field cannons along the coast proved unsuccessful, a special 5-cm antiballoon cannon was constructed, followed the next year by a 6.5-cm cannon. Here and there such cannons were used in the imperial maneuvers before the Great War. The experience gained in these tests led to the demand for 32 7.5-cm cannons for the German peace-time army. When war broke out in 1914, the German Army had altogether 18 antiballoon cannons at its disposal. A ridiculous number—yet no other country beside Germany possessed even a single antiaircraft cannon.

The Great War naturally entailed a rapid development of this new weapon. As the emphasis shifted from balloons and airships to airplanes, the demands placed upon the weapon increased manifoldly. The name was adapted to the changing target: the antiballoon cannon became the antiaircraft cannon or *Flugzeug-Abwehr-Kanone* in German, which was shortened to the now so familiar "Flak." In the course of the four years of war, the caliber of the heavy Flak rose to 8.8 and 10.5-cm. All the complicated auxiliary equipment came into being: searchlights, range finders, sound-detecting apparatus. The munition was also improved. The 18 AA-cannons at the outbreak of the war had grown by the Armistice to 2,576 cannons, which were used on all fronts.

The Versailles Treaty put an end to this new weapon for Germany. The Reichswehr was only allowed to keep a few cannons mounted in the obsolete forts of Königsberg in East Prussia. Nevertheless, officers and men were trained at the Königsberg cannons and later organized into motorized detachments of the Reichswehr. This was how the gap was bridged between the artilleryists of the Great War and Germany's new Flak artillery, which since April 1, 1935, has been incorporated in the Air Force. Since the German engineers had not been idle either, and the Reichswehr was in possession of models of the most modern aiming and firing equipment within ten years of the Armistice, the new arm immediately found itself in possession of excellent equipment, which has since been further improved.

The new arm underwent its first test in the Spanish Civil War as part of the "Condor Legion." It was there that the hitherto unexcelled "8.8" was also used for the first time against tanks.

The mobility and adaptability of modern anti-aircraft artillery have in the present war enabled it to carry out the most varied tasks in land, air, and naval fighting. Flak helped in 1940 to crack the hardest nuts in the Maginot Line. Flak defeated the dreaded T 34 tank of the Soviets. Flak helped to destroy the close-packed waves of Bolshevik attackers. Flak protected the troops crossing the Strait of Messina. Flak's deadly missiles reached many an enemy warship which carelessly approached the coast. There are AA combat units, generally equipped with several heavy guns protected against flank attacks or low-level air attacks with light cannons. Before Germany had brought out the Tiger tank with its heavy weapons, the heavy Flak was part and parcel of the tank battles in the East and in Africa. There was hardly a tank immune to the smashing force of its armor-piercing shells.

But what is most familiar to the German population is the anti-aircraft artillery around every German city. Everyone knows the Flak soldiers living outside the city in their green barracks, the sinister-looking gun barrels, the light gun emplacements on rooftops, the searchlight positions and the crisscross of electric wires over the fields. The barking detonations of the shots, the whistling hiss of the shells, the thudding explosions of the charges in the sky—all these are familiar sounds in the grim concert of air battles.

The attacking of air targets has remained the most important and at the same time by far the most difficult task of the anti-aircraft artillery. The ground target is either im-

movable, or it moves in two directions more or less slowly and constantly. The air pilot, however, has three dimensions at his disposal in which he can move unhindered at the greatest possible speed and with swift change of direction. The darkness of night affords him added protection.

It needs no further explanation that to shoot down an airplane with artillery from the ground is one of the most difficult problems known in technical warfare. Anyone who has ever been out shooting knows that he must aim slightly ahead of a bird in flight if he wants to hit it. And the calculation of this aiming ahead—in respect of altitude, direction, and distance—is the alpha and omega of anti-aircraft firing. Even the fast-moving AA shells require up to half a minute to reach planes at high altitudes. At a flying speed of 400 kilometers per hour (or 110 meters per second), this means that the shell has to be aimed 3.3 kilometers ahead! This, moreover, takes for granted that the plane does not change its altitude, its speed, or its direction. Should it change its altitude, it becomes necessary to aim ahead at the new altitude too; should it change direction, the curve must be taken into account; and if it should change its speed, all calculations for aiming ahead must be adjusted accordingly.

Thus from the route of the plane under observation, the route must be calculated which the plane is likely to take during the time the shell is rushing up. Should the pilot change his direction even very slightly in any one of the three dimensions, the shot will miss its target.

The Flak tackles these problems with the utmost accuracy by means of a complicated automatic calculating apparatus. A calculation which, with the aid of logarithm tables and higher mathematics, might perhaps be carried out within an hour for one point of the route, is carried out constantly for every instant of the plane's route by this automatic equipment. For every point at which the plane happens to be, a target point is obtained by a combination of the various factors affecting the aim. While the binoculars attached to the calculator follow the target, the barrels of the guns point far ahead at the spot where the plane will be according to these calculations. At night, when mist or clouds prevent the searchlights from spotting the target, another apparatus is employed which spots the invisible planes and in turn—but without optical aids—calculates the route they take.

The cannons are connected with the calculating apparatus by cables and are directed electrically, so that the artilleryists at their wheels and levers have only to follow the indicators exactly.